

<i>Issue Date</i>	<i>Org. Code</i>
3-3-92	W/OS032

NATIONAL WEATHER SERVICE

Engineering Handbook

<i>Program</i>	<i>Part</i>	<i>Section</i>
EHB-8	00	0.0

DIRECTIVES FOR SURFACE EQUIPMENT

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PART 1

SURFACE EQUIPMENT (EHB-8)

Equipment Manuals Equipment or systems manuals are provided with each piece of operational equipment used in the National Weather Service (NWS). Each manual includes sufficient instructions so that technicians not familiar with the equipment can satisfactorily accomplish installation, necessary adjustments and calibration, activation, routine and emergency maintenance, and can easily identify components for ordering replacements. As a minimum, manuals contain information regarding (a) description and characteristics of the equipment; (b) siting and installation requirements; (c) activation, adjustment, and operation; (d) description of circuits utilized; (e) preventive and troubleshooting maintenance procedures, including resistance and voltage measurements and mechanical adjustments; (f) detailed circuit diagrams; (g) detailed parts list indicating parts numbers, together with electrical and mechanical descriptions.

Manuals are issued by the NWS Office of Systems Operations Engineering Division whenever new equipment is installed, when sufficient changes in manual material require a complete revision, or by request from authorized personnel whose responsibilities have changed, thus requiring their having access to additional technical material. Manuals will normally be revised when sufficient change in the material is brought about through equipment modification, change in technical procedures and from suggestions obtained from the field requesting clarification of vague or erroneous information.

Distribution of equipment manuals in the automatic observing program area is made on a selective basis. Normally only those electronics technicians actually maintaining the equipment will be issued manuals. One copy is provided with the equipment and remains in the custody of the station.

All equipment manuals will be numerically coded so as to be keyed to the appropriate program area handbook. The indexes contained in Part I for the various systems and equipment manuals indicate the numbers assigned to a particular manual. As new manuals are obtained, they will carry the coded number on the cover as a reference.

The recipient of equipment manuals will be responsible for their upkeep as regards filing of revised material and ensuring that they are current. Area electronics supervisors will periodically check electronics technicians' manuals for completeness and have them request any revisions that are missing. Request for manuals should be made through the regional headquarters Systems Operations Division to NWS Office of Systems Operations Engineering Division (ATTN: W/OS032). Manuals should be requested only for equipment under the technician's responsibility.

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MANUAL INDEX - CLOUD MEASURING EQUIPMENT

<u>Number</u>	<u>Title</u>
8-111**	Instruction Book A-149, Crouse-Hinds Co., Type DCE-16 Ceiling Light Projector
8-112**	Ceiling Light Projector, Crouse-Hinds DCE-16 Instruction Book A-242A (July 1968)
8-113**	Ceiling Light Projector, Westinghouse
8-114**	Sealed Beam Ceiling Light Projector
8-116**	Crouse-Hinds DCE-16 Ceiling Light Projector, A242B (K103)
8-119**	Rotating Beam Ceilometer Recorder, T.H. Giff

** Sent Only with Original Equipment -- Not Available Otherwise

Items 8-100 through 8-110, 8-115, 8-117 and 8-118 have been deleted.

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EHB-8	01	1.2

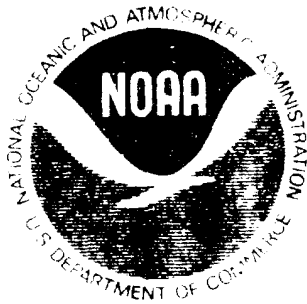
MANUAL INDEX - WIND EQUIPMENT

<u>Number</u>	<u>Title</u>
8-200	Instruction Manual for Wind Equipment (1958)
8-201"	Addendum, Change 1 - Transmittal Memorandum No. 1, December 4, 1965
8-204**	Instruction Book for Indicating Wind Set - U.S.W.S. No. 420D
8-205**	Operational and Service Instructions, with Parts List, for Model C1-9D Wind Recording Systems (Site Survey Equipment)
8-207**	Instruction, Type CD Recording Instrument, General Electric Handbook GEH 719P
8-208	General Instructions for the Operation and Maintenance of Esterline-Angus Model AW Recording Instruments (1S10)
8-209	General Instructions for the Operation and Care of Esterline-Angus Chart Drives (1S20)
8-210	Instruction for Operation and Maintenance of Esterline-Angus Model AW Operation (Event) Recorders (1S50)
8-211	Instructions for Esterline-Angus Model AW D.C. Milliammeter (Permanent-Magnet Moving Coil Type) (1S42)
8-212**	Instructions for Installation of Winds Aloft Timers
8-213	F611 Solid State Wind Retransmitter
8-214*	Directions Manual, Speedomax W/L Recorder, No. 177400, Issue 4, Leeds & Northrup
8-215*	Parts Catalog, No. 179024, Speedomax W/L Recorder, Leeds & Northrup

* No Longer Available

** Supplied only to those using this type equipment

Items No. 8-202, 8-203 and 8-206 have been deleted.



U.S. DEPARTMENT OF COMMERCE

Peter G. Peterson Secretary

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Robert M. White Administrator

NATIONAL WEATHER SERVICE

George P. Cressman, Director

F611
SOLID STATE WIND
RETRANSMITTER

ENGINEERING DIVISION
INSTRUCTION MANUAL NO. 8-213
SILVER SPRING, MD.



U.S. DEPARTMENT OF COMMERCE -
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE
Silver Spring, Md. 20210

INSTALLATION AND OPERATION

OF

F611, SOLID STATE TYPE WIND SPEED AND DIRECTION RETRANSMITTER

General - The F611 solid state retransmitter (Figure 1) is an electronic device designed to be used with the F420 series wind equipment. It permits operation of F420 equipment over lines of greater length than is possible in a standard direct-line, or with the magnetic amplifier type installation. Up to nine wind speed and direction indicators can be driven by one F611 retransmitter. The unit is designed to operate from a 105-125 volt, 60 hertz power source. If more than one retransmitter is used with the, same system, they should be connected in series.

DESCRIPTION:

The retransmitter is mounted on a 19" x 8-3/4" panel designed for mounting in a standard equipment cabinet. The wind speed section consists of one plug-in printed circuit board, a modular ± 15 VDC power supply, and a switch that permits applying a +3 VDC to the wind speed input signal for checking the performance of the amplifier.

The wind direction section consists of two plug-in printed circuit boards, Weather Service Stock Number F611-A, a modular ± 15 VDC power supply, a ± 25 VDC supply, and a switch that provides a ± 3 VDC to the input of the wind direction amplifier for the purpose of testing and calibration. Figure 2 is the component board layout of F611-A.

INSTALLATION:

The retransmitter should be located so that the master panel can be observed when calibration checks are being performed on the retransmitter. Five signal lines are needed to connect the retransmitter to the field wind installation - two lines for the speed and three for the direction. Figure 4 is the interconnecting wiring diagram for an F420-C wind system using a F611 retransmitter.

Speed Circuit

The two lines from the wind speed transmitter should be terminated at the field site into a 428.6 ohm, 0.1% resistor in parallel with the transmitter output. The "A" and "B" leads from the transmitter site

should be connected to the "F" and "G" leads, respectively, of the transmitter. The output of the wind speed section of the retransmitter will work into a wind panel load from 428.6 to 1500 ohms. Any combination of F420 type wind speed indicators connected in series, parallel, or series parallel, which have a load value within this range may be used. Load connections should be to terminals "L" (positive) and "M" (common) of the retransmitter.

Direction Circuit:

A 12 VDC power supply should be used at the field site to feed the "D" and "E" leads of the transmitter ("D" positive and "E" negative). Power supplies, Weather Service Stock Number F603 are available from the CLSC, Kansas City, Mo. The "A", "B", and "C" lines from the transmitter connect to correspondingly labeled terminals on the retransmitter. The output of the wind direction section of the retransmitter will drive up to nine indicators. The "A", "B", and "C" leads from the indicators connect to output terminals "H", "J", and "K", respectively, on the retransmitter. It should be noted that "E" lead of the transmitter and the negative side of the 12 VDC power supply are not grounded.

Theory of Operation:

Modules A, B, and C are identical amplifiers that can be used for either wind direction, or wind speed retransmitting.

The amplifier is divided into two sections - a preamplifier, and a complementary power amplifier. The input section (preamplifier) is an operational-amplifier used in the follower-amplifier configuration. The follower circuit has essentially unity gain because the output is fed directly back to the negative input as degenerative feedback. The follower has an input impedance that is very high (greater than one megohm) therefore, ideal for isolating from other circuits. When the module is used for wind speed, only the preamplifier section is used. This is accomplished by not applying power to the power amplifier section (± 25 VDC) of the connectors for module C.

When the module is used for wind direction retransmitting (positions A or B), both the preamplifier section and power amplifier section are utilized. The power amplifier section is needed in the wind direction modules because of the greater current requirement caused by the output loading of the wind direction meters, (up to nine meters).

Calibration:

The retransmitter does not have a calibration adjustment for wind speed or direction like the F607 due to the very high input resistance of the circuitry. The speed test voltage is obtained from a constant voltage source which maintains a constant reading for wind speed checks. The indication obtained for wind speed tests when the unit is installed, should not change unless the meter, power supply, or the wind speed circuitry becomes defective. The wind direction test voltage is obtained by the same method and the indications obtained for the initial test should not vary unless some circuitry is defective.

Printed circuit board positions A and B are for wind direction. Printed circuit board position C is for wind speed. Module C should also be tested in position A or B to verify that the power amplifier section is working satisfactorily so that it can be utilized in position A or B also.

Switch S3, in the 0, 120, and 240 degree position supplies approximately a +3 VDC to the inputs of printed- circuit boards A and B. The position of S3 determines the polarity of the inputs to the boards. This allows checking the direction amplifier with both a +3VDC and -3VDC applied to the input. Any indication within plus or minus 5 degrees from the setting of S3 is acceptable. Values outside the tolerance should be investigated, if it is known that the direction meter is accurate.

The wind speed test switch S2, in TEST position, supplies a +3 VDC to the input of printed circuit board C. S2 is connected as an OFF/ON switch with no provision for reversing the polarity. This is the reason for changing board C with boards A or B for complete testing. The wind speed meter should indicate about 66.5 knots in the test position. However, due to line voltage variations, manufacturing processes of component parts and junction resistivity, this indication may vary. Therefore, the indication noted upon installation should be regarded as valid for all future comparisons if it falls within the area of 66.5 knots. Indications of values obtained at later dates, varying from the initial indication, should be investigated if it is known that the speed meter is accurate.

Maintenance:

The retransmitter is considered to be an on-station repairable item and should be treated as such. Spare boards and power supplies are available from the CLSC and most of the other components are commercial grade which should be obtained locally. Figure 3 is the schematic diagram and parts list of the F611 retransmitter.

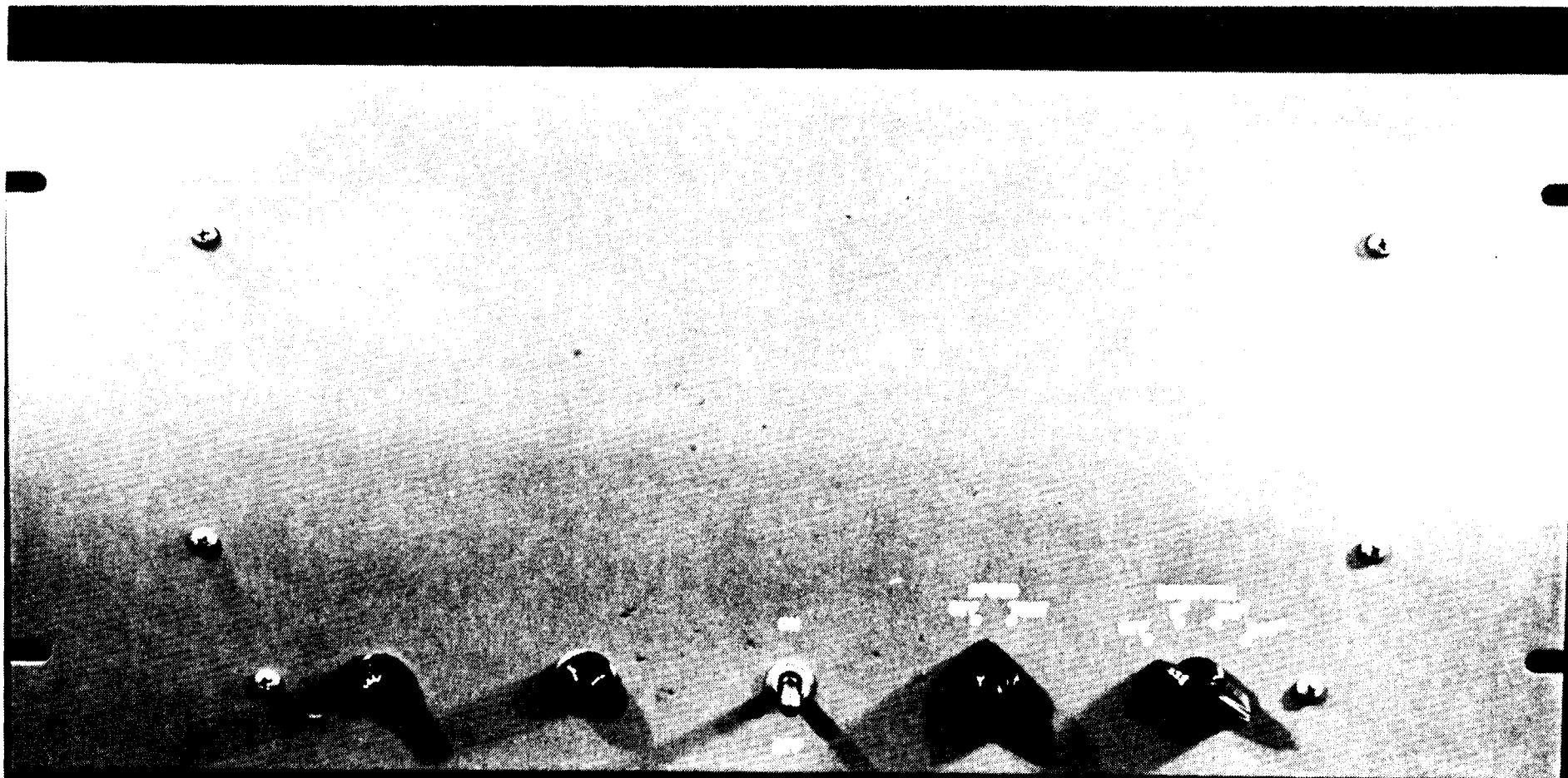


Figure 1-F6II Solid State Wind Retransmitter

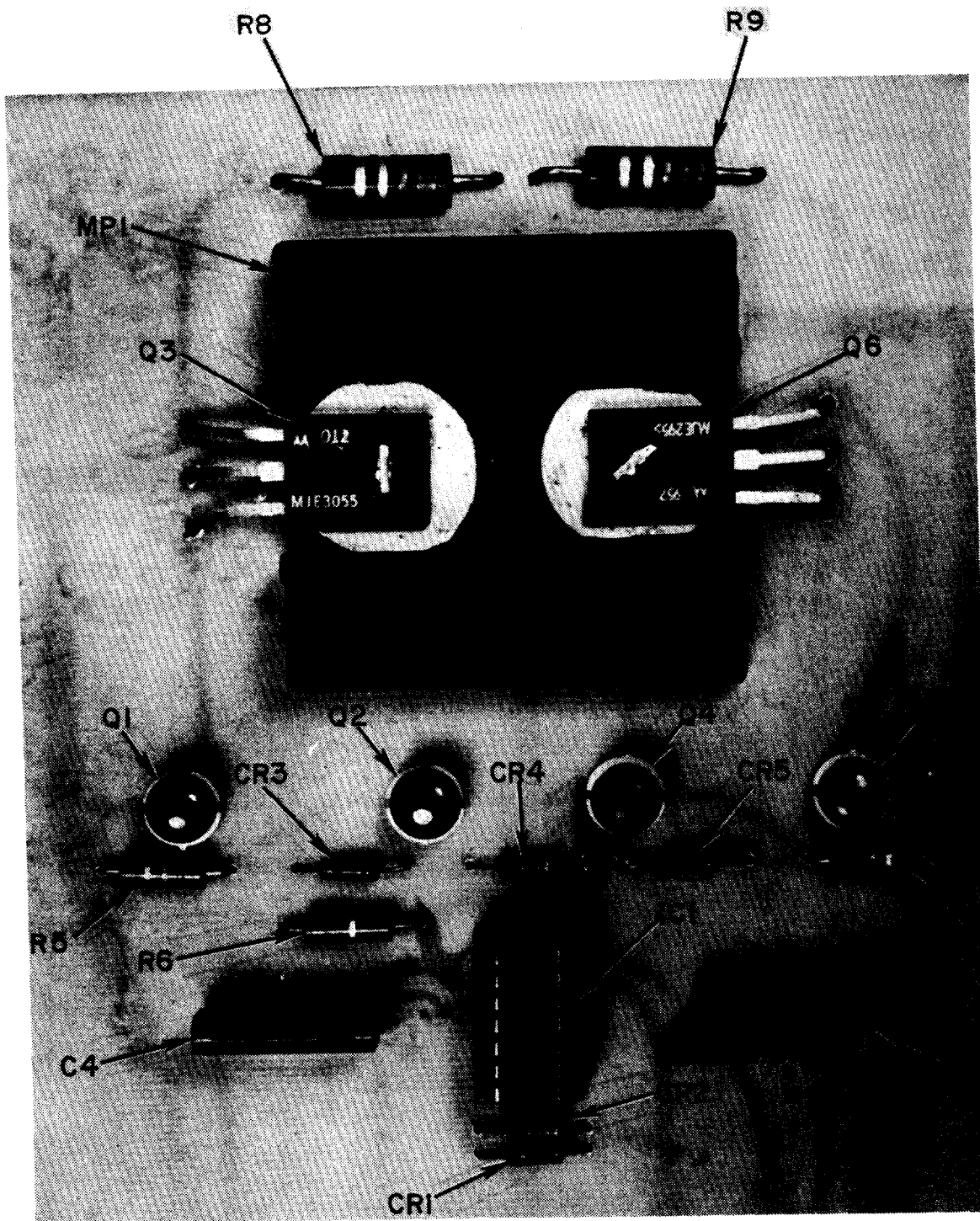
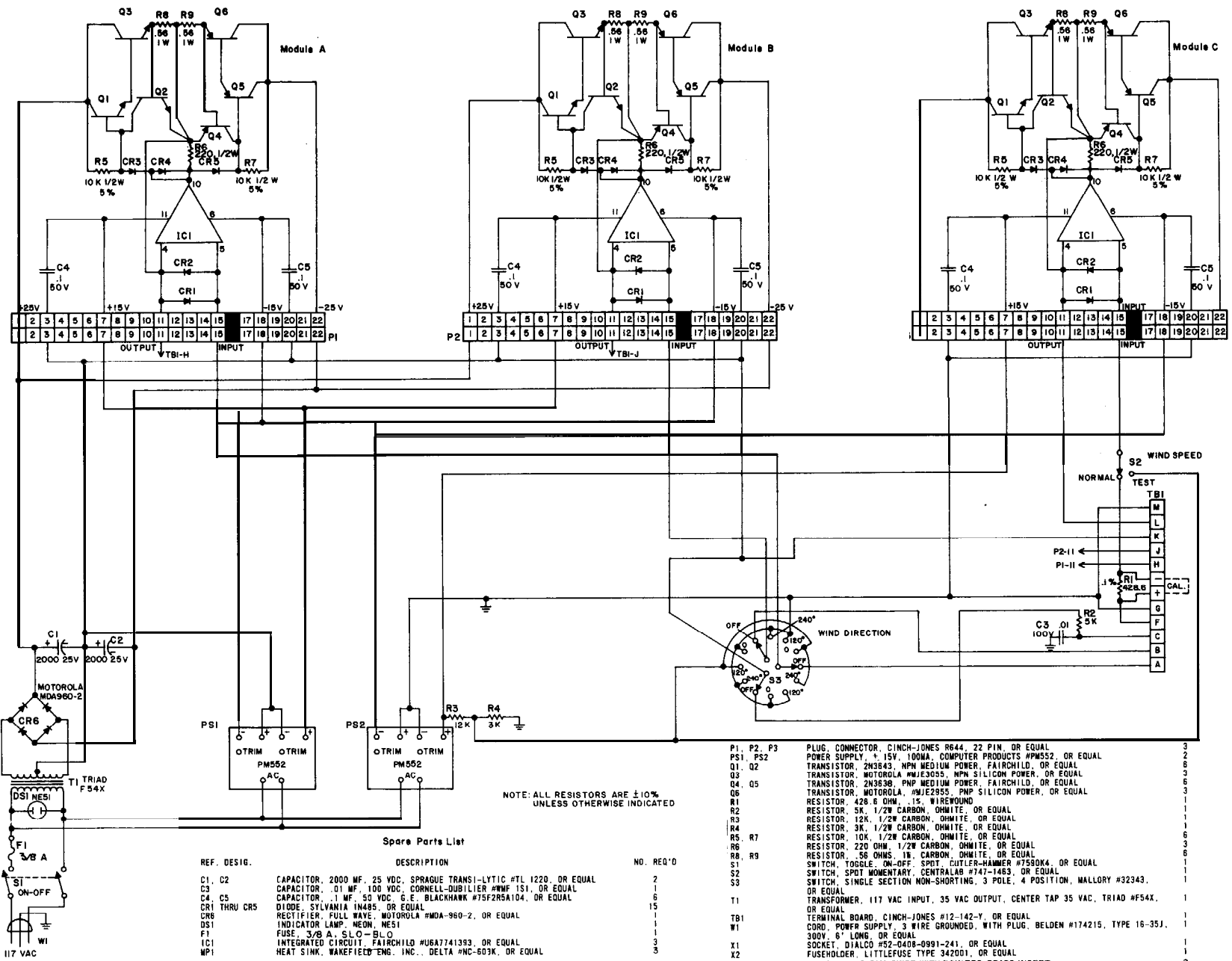


Figure 2-F611A P.C. Board Component Layout

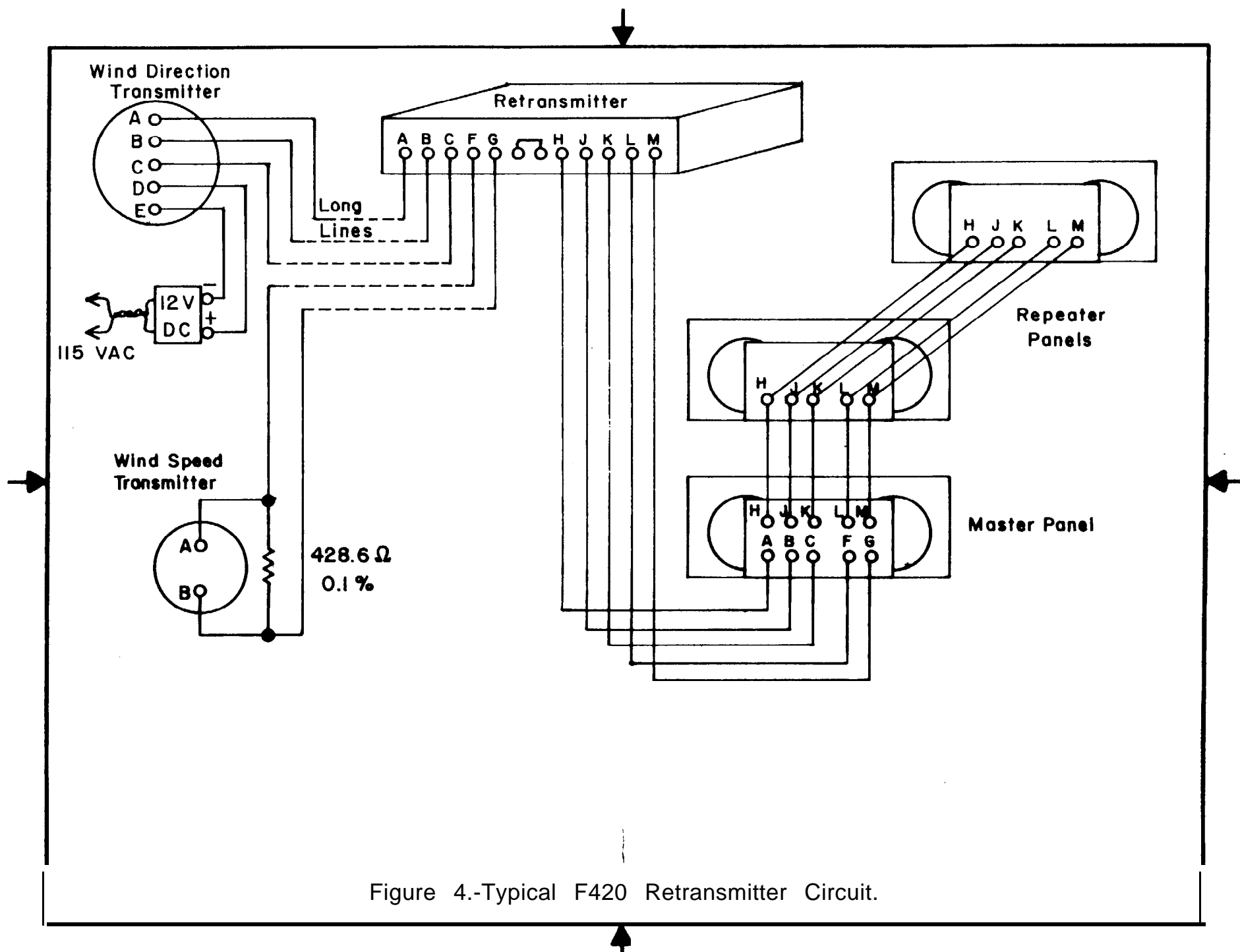


NOTE: ALL RESISTORS ARE $\pm 10\%$ UNLESS OTHERWISE INDICATED

Spare Parts List

REF. DESIG.	DESCRIPTION	NO. REQ'D
C1, C2	CAPACITOR, 2000 MF, 25 VDC, SPRAGUE TRANS-LYTIC #TL 1220, OR EQUAL	2
C3	CAPACITOR, .01 MF, 100 VDC, CORNELL-DUBILIER #MMF 151, OR EQUAL	1
C4, C5	CAPACITOR, .1 MF, 50 VDC, G.E. BLACKHAWK #75F2R5A104, OR EQUAL	6
CR1 THRU CR5	DIODE, SYLVANIA 1N485, OR EQUAL	15
CR6	RECTIFIER, FULL WAVE, MOTOROLA #MMA-960-2, OR EQUAL	1
DS1	INDICATOR LAMP, NEON, NES1	1
F1	FUSE, 3/8 A, SLO-BLO	1
IC1	INTEGRATED CIRCUIT, FAIRCHILD #U6A7741393, OR EQUAL	3
MP1	HEAT SINK, WAKEFIELD ENG. INC., DELTA #NC-603K, OR EQUAL	3

P1, P2, P3	PLUG, CONNECTOR, CINCINNATI #R644, 22 PIN, OR EQUAL	3
PS1, PS2	POWER SUPPLY, 15V, 100MA, COMPUTER PRODUCTS #PM552, OR EQUAL	2
Q1, Q2	TRANSISTOR, 2N3643, NPN MEDIUM POWER, FAIRCHILD, OR EQUAL	6
Q3, Q4, Q5	TRANSISTOR, MOTOROLA #MJE3055, NPN SILICON POWER, OR EQUAL	3
Q6, Q7	TRANSISTOR, 2N3638, PNP MEDIUM POWER, FAIRCHILD, OR EQUAL	6
Q8, Q9	TRANSISTOR, MOTOROLA #MJE2955, PNP SILICON POWER, OR EQUAL	6
R1	RESISTOR, 420 OHM, 1/2W, WIREWOUND	1
R2	RESISTOR, 5K, 1/2W CARBON, OHMITE, OR EQUAL	1
R3	RESISTOR, 12K, 1/2W CARBON, OHMITE, OR EQUAL	1
R4	RESISTOR, 3K, 1/2W CARBON, OHMITE, OR EQUAL	1
R5, R6	RESISTOR, 10K, 1/2W CARBON, OHMITE, OR EQUAL	6
R7	RESISTOR, 220 OHM, 1/2W CARBON, OHMITE, OR EQUAL	3
R8, R9	RESISTOR, .56 OHMS, 1W, CARBON, OHMITE, OR EQUAL	6
S1	SWITCH, 100LE, ON-OFF, SPOT, BUTTERFLY #75804, OR EQUAL	1
S2	SWITCH, SPOT MOMENTARY, CENTRALAB #747-1463, OR EQUAL	1
S3	SWITCH, SINGLE SECTION NON-SHORTING, 3 POLE, 4 POSITION, MALLORY #32343, OR EQUAL	1
T1	TRANSFORMER, 117 VAC INPUT, 35 VAC OUTPUT, CENTER TAP 35 VAC, TRIAD #F54X, OR EQUAL	1
TBI	TERMINAL BOARD, CINCINNATI #12-142-Y, OR EQUAL	1
W1	CORD, POWER SUPPLY, 3 WIRE GROUNDING, WITH PLUG, BELDEN #174215, TYPE 16-35J, 300V, 6' LONG, OR EQUAL	1
X1	SOCKET, DIALCO #52-0408-0991-241, OR EQUAL	1
X2	FUSEHOLDER, LITTLEFUSE TYPE 342001, OR EQUAL	1
	NOB, ROUND, DIAL SKIRT WITH POINTER, BRASS INSERT	2



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EHB- 8	01	1. 3

MANUAL INDEX - RADIATION EQUIPMENT

<u>Number</u>	<u>Title</u>
8-300	Manual of Radiation Observations (July 1962) (DATAC)
8-304	Maintenance of Photoelectric Sunshine Switch and Associated Indicator Panels (June 9, 1959)
8-305	Instruction for Installing and Operating National Weather Service Photoelectric Sunshine Switch in conjunction with Sunshine and Precipitation Indicator Magnetic Amplifier Type (August 15, 1963)
	For Instruction Manuals for operational recorders, look under Esterline-Angus Recorders listed with Wind Equipment
8-309*	Instructions for installing the Equatorial Mounting for Normal Incidence Pyrheliometers, July 26, 1956
8-310*	Dobson Spectrophotometer
8-311*	Ozone Spectrophotometer Adjustment and Calibration Manual
8-312*	Observers Manual, Dobson Ozone Spectrophotometer

* Supplied only to those using this type equipment

Items 8-301 to 8-303, 8-306 to 8-308, and 8-313 to 8-315 have been deleted.

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NATIONAL WEATHER SERVICE

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EHB-8	01	1.4

MANUAL INDEX - HYGROTHERMOMETER SYSTEMS

Number

Title

8-406**

H083 Temperature/Dewpoint Monitoring System

Errata Sheet 1 Pen and Ink Changes to the H083
Hygrothermometer Manual Volume #3 (March 5, 1990)

Errata Sheet 2 Pen and Ink Changes to H083 Hygrothermometer
Volume #2 (April 23, 1990)

** Supplied only to those using this equipment

Items 8-400 through 8-405 have been deleted.

Pen-and-ink changes to the H083 Hygrothermometer manual volume ²~~22~~

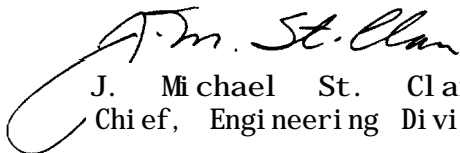
General:

Errata sheet No. 1 provides pen-and-ink changes to the H083 Hygrothermometer manual volume ²~~2~~ transmitter and display interconnection wiring diagrams.

Effects on Other Instructions: None.

Procedure:

1. H083 Hygrothermometer manual volume 2, page 3-3 (Wiring Diagram Transmitter), make the following connector labeling changes:
 - a. Connector 2J2 pin 2 should be labeled 2X3-3 vice 2X3-4.
 - b. Connector 2X3 pin 6 should be labeled 2S2-5 vice 2S2-1.
 - c. Connector 2X3 pin 12 should be labeled 2S2-1 vice 2S2-5.
2. H083 Hygrothermometer manual volume 2, page 3-5 (Wiring Diagram Display Unit), make the following connector labeling changes:
 - a. Connector X1 pin D should be labeled 20R vice 20BK.
 - b. Connector X1 pin M should be labeled BK/GRN vice BK/ORN.


J. Michael St. Clair
Chief, Engineering Division

Pen-and-ink Changes to the H083 Hygrothermometer Manual Volume ~~2~~³

General:

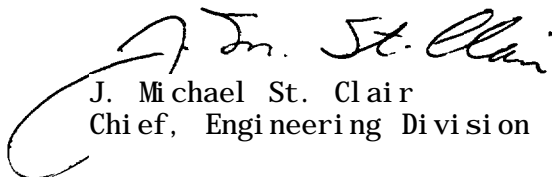
This errata sheet provides pen-and-ink changes to the H083 Hygrothermometer Manual volume 2.

Effect on Other Instructions:

None

Procedure:

1. H083 Hygrothermometer Manual volume 2, page 2-7, schematic diagram Dew Point Sensor. Remove the line from Q1 collector to the Q2 emitter. Draw a new line between Q1 collector to Q2 collector.
2. H083 Hygrothermometer Manual volume 2, page 2-11, schematic diagram Transmitter Unit. Remove the line between J2 pin #1 (HEAT/COOL POWER) Autobalance Input that connects to J1 pin R (THERMO POWER). Draw a new line that connects J2 pin #1 (AUTOBALANCE INPUT) to 2A4 (AUX. POWER SUPPLY P/N 1063-203) X2 pin #1.
3. H083 Hygrothermometer Manual volume 2, page 2-19, schematic diagram Transmit Logic. Change the reference designation CR6 to CR7 and CR7 to CR6.



J. Michael St. Clair
Chief, Engineering Division



U. S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE
Silver Spring, Md. 20910

September 25, 1984

W/OTS141: TEC

TO: Chiefs, Electronics Branches, All NWS Regions

FROM: W/OTS14 - William J. Von Feldt *William J. Von Feldt*

SUBJECT: H0-83 Hygrothermometer Manual Distribution

ACTION: For your information

The H0-83 manuals will not be ready for distribution with the H0-83 instrument package. They will not be available until late November or December. The manuals will, of course, be dispatched to all stations that have received an H0-83 system.

It is anticipated the first 70 stations will not receive their manuals with the equipment. Therefore, this distribution of selected pages from the manual is to assist the technician in the maintenance of the LRU level. This additional material in conjunction with the Technical Information Package (TIP) will act as an informational stop gap until the manuals arrive.

Should there be any reservations, the regions may delay their station installations until the receipt of the manuals.

CC:

W/OTS21 - J. Lehmann

W/OTS13 - G. Snyder



OVERALL FUNCTION DIAGRAM KEYED TEXT

①

SENSING FUNCTION

Sensing Function consists of all circuits necessary to provide a pair of electrical signals (resistance values R_{Ta} and R_{Td}) which represent Ambient Temperature, T_d , and Dew Point Temperature, T_d . Components of the Sensing Function are located in the Aspirator Unit and in the Transmitter Unit. Physical measurement of Dew Point is made by way of a chilled mirror optical system.

②

ANALOG SIGNAL CONDITIONING

This functional group receives the two resistance values representing ambient temperature and dewpoint temperature, and converts the values into a pair of DC voltage levels, V_{Ta} and V_{Td} , which are proportional to the two temperatures of interest. Included in the signal path is a calibrator which provides a convenient means of checking and adjusting the calibration of the system. Following the conversion to DC analog signals is a multiplex gate which allows the two channels of data to share a single output line for data transmission.

③

DATA TRANSMISSION

The multiplexed analog representation of ambient temperature (T_a) and dewpoint temperature (T_d) is processed into a parallel binary digital data format, still multiplexed alternately as T_a and T_d . This data is presented to a parallel input port of a data processor which performs all of the necessary storage and formatting to convert the data into a serial stream suitable for transmission over a telephone-quality line. The data stream is transmitted at a 600 Baud rate, 5 frames of data per second. Each frame of data alternately transmits T_a and T_d value. For use in servicing the equipment, a data receiver and numeric data display are included in the data transmitter package. By switch selection, the user may select T_a or T_d presented as a decimal numeric display.

4

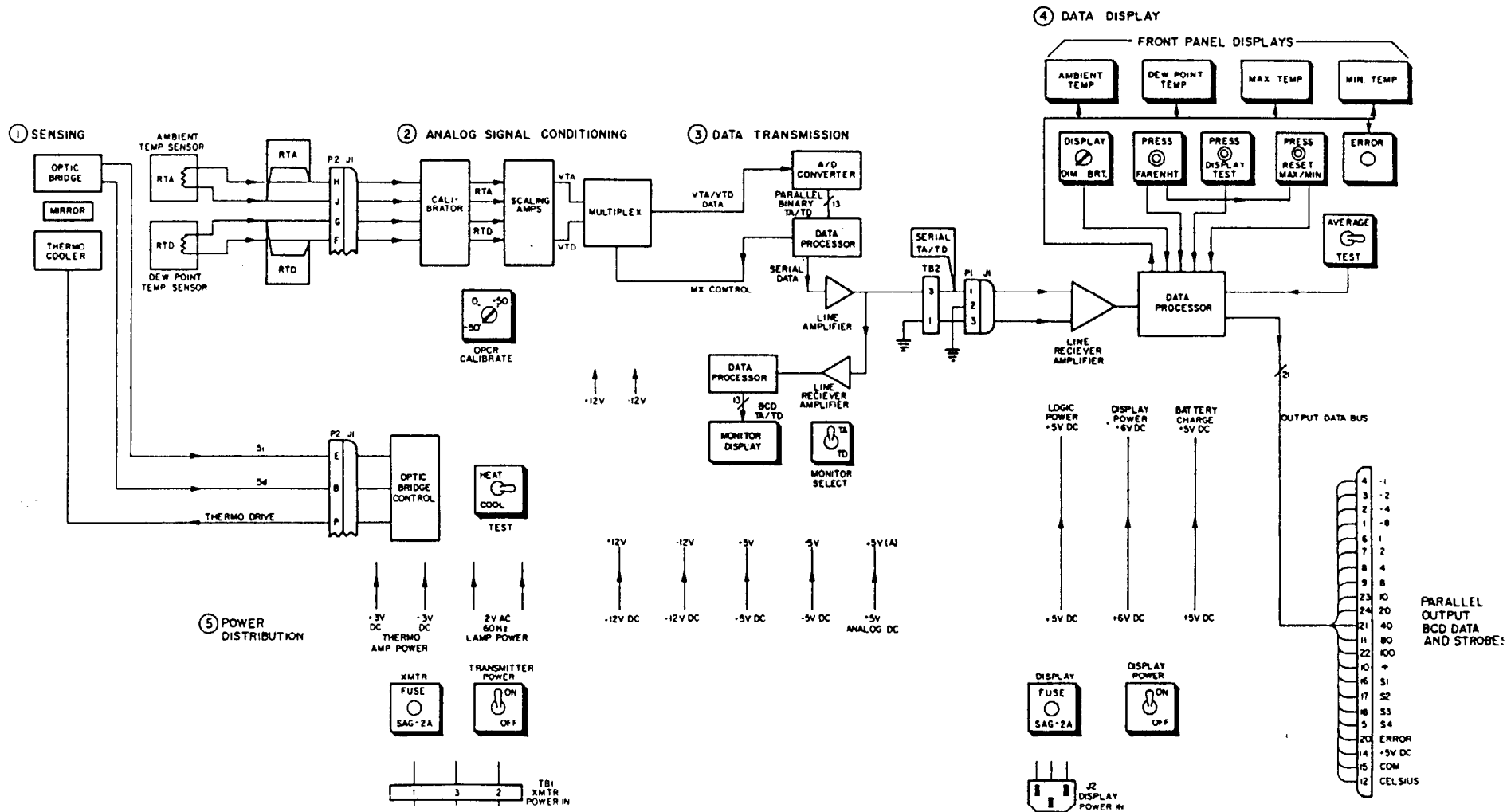
DISPLAY FUNCTION

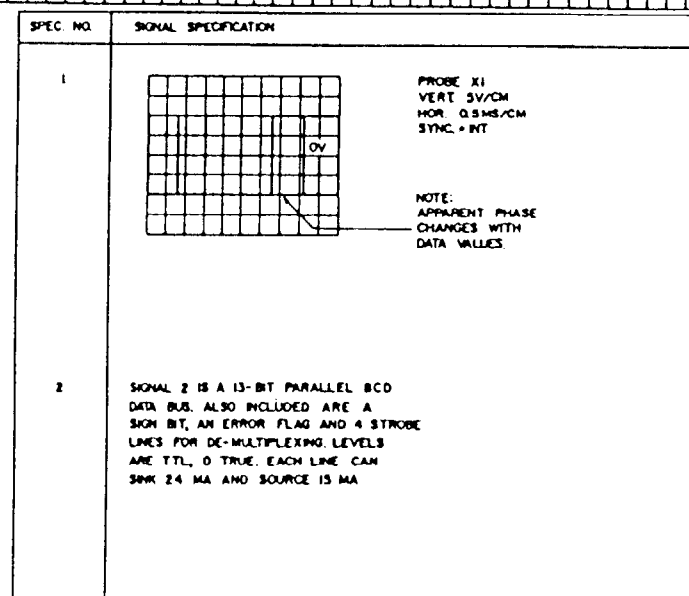
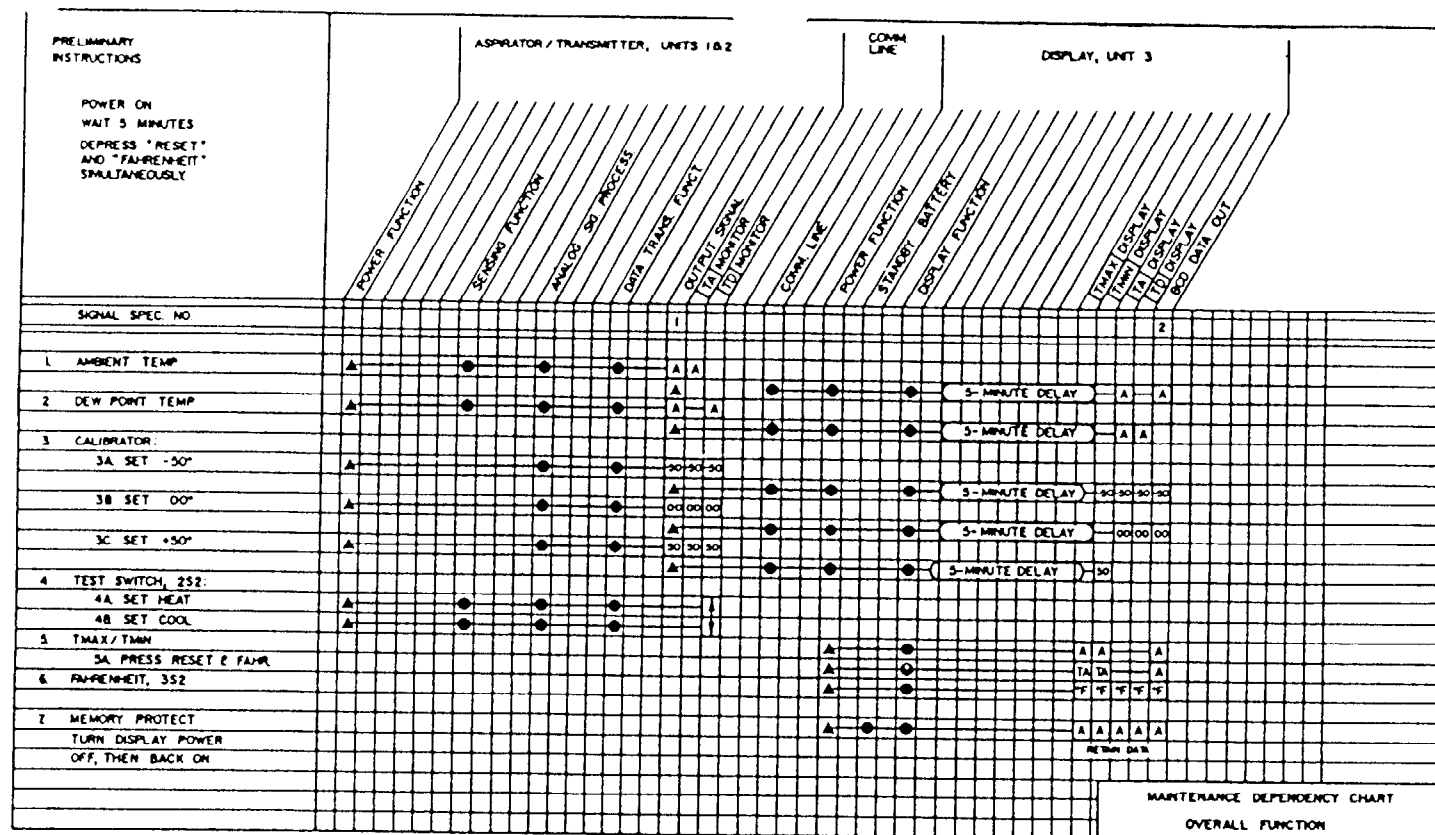
The serial data stream is received from the data transmitter and converted into a parallel format suitable for output display. Also included in the Display Function are arithmetic processes which average the Ta and Td data, and maintain current values of maximum and minimum values of Ta. Ta, Td, Tmax, and Tmin are continuously displayed on the front panel of the Display Unit. All of the data are also buffered and brought to a rear panel connector.

5

POWER DISTRIBUTION

The Power Distribution function includes all of the necessary circuits to provide and distribute AC and DC power levels to the components of the hygrothermometer. Using independent 115 volt, single phase, 60 Hz inputs at the Transmitter and Display units, voltages are developed and regulated as required. Input to the Aspirator, Unit 1, is furnished by cable from the Transmitter, Unit 2.

UNIT 1
ASPIRATORUNIT 2
TRANSMITTERUNIT 3
DISPLAY



SENSING FUNCTION KEYED TEXT

① OPTIC BRIDGE

The Dew Point Sensor assembly, 1A1, includes the sensing elements for both dew point and ambient temperature measurements. Dew point measurement is made by the Optic Bridge in the Aspirator Unit, in which a mirror surface is cooled and held at exactly the temperature at which a fine film of condensate forms and is maintained. The Optic Bridge includes a thermoelectric heat pump, U1, which is electrically controlled by the Optic Control portion of the Transmit Logic PC assembly in the Transmitter Unit. A platinum temperature sensing resistor, RT2, in the mirror block assumes a resistance value exactly proportional to the mirror temperature. This resistance value is used as the basis for the Td data value.

The Optic Bridge includes an infra-red LED, CR1, which illuminates a mirror block, and two photosensitive transistors, Q1 and Q2, which sense the direct and scattered reflection from the mirror. When the mirror is not cool enough, the direct reflection (Sd) is high and the indirect reflection (Si) is low. If the mirror surface is too cool, the opposite situation exists. The phototransistor output signals, Sd and Si, serve as inputs to the Optic Control section of the sensing function, which maintains balance between Sd and Si, holding the mirror at exactly the dewpoint temperature. Input to the bridge lamp is a 60 Hz voltage, so that Sd and Si are AC signals.

② OPTIC BRIDGE CONTROL

In the Transmit Logic PC assembly of the Transmitter Unit, the Optic Bridge Control section receives the Direct and Indirect optical signals, detects, and amplifies the difference between the amplitudes of the Sd and Si DC levels. The difference signal, amplified by U6B, is fed to the Thermo Power amplifier, Q1 and Q2 of the Auxiliary Power Supply in the Transmitter Unit. The Thermo Power amplifier produces a DC output varying between + and - 3 volts DC to drive the thermoelectric heat pump, U1, in the Optic Bridge assembly in the aspirator. The polarity of the power output produces heating or cooling of the mirror to tend to make the Si and Sd signals equal.

③ Sd LEVEL INDICATOR

For use in adjusting the optic control system, Light Emitting Diode CR5 indicates when the direct light signal, Sd, is at its proper level. Sd amplifier gain is adjusted to produce +5 volts DC in the clear mirror condition. When the Sd level is at +5vdc or slightly higher, threshold amplifier U5B saturates positive, lighting CR5.

④ HEAT/COOL TEST SWITCH

Also for use in testing and adjusting the equipment, the operator is provided with a switch, by which he can introduce a DC unbalance in the optic control loop, causing the mirror to heat or to cool.

⑤ HEAT/COOL LIMIT DETECTOR

Normally, when the optic control loop is functioning, feedback amplifier U6B maintains a moderate output level, providing the necessary DC level to maintain the mirror at the dew point temperature. In this normal condition, the voltage at the input node of U6B is virtually zero. If the loop should fail to maintain balance because of mirror condition or component failure, U6B will assume a saturated condition, and its node voltage will increase to a relatively high value. The node voltage is monitored by high-gain amplifier U7B, driving indicators LED's CR6 and CR7. If the U6B node voltage becomes excessive in the positive or negative direction, one of the LED's will indicate the abnormal condition. The output of U7B is also used as an error input to the data transmitter, so that the malfunction can be displayed remotely.

⑥ TEMPERATURE SENSING

Two identical platinum temperature sensors, RT1 and RT2, are located in the Dew Point Sensor assembly. RT2 is mounted in the body of the mirror and assumes the temperature of the mirror which is at the dew point. RT1 is mounted directly in the incoming air stream of the aspirator and assumes the ambient air temperature. The resistance values of RT1 and RT2 are exactly proportional to their temperatures. These resistance values are used as the basis of measurement of Ta and Td.

7

ASPIRATION

For the ambient and dew point sensors to function properly, an ample supply of air must be furnished. The aspirator fan, B1, provides a stream of air for the Ta sensor and for exhausting the heat generated by the thermoelectric cooler.

8

Si LEVEL INDICATOR

Threshold amplifier U21B detects when the Si level is at -3 volts DC, lighting LED CR9. This is used as an aid in adjusting Si gain.

9

OVERHEAT PROTECTION

If a Td or Ta temperature value greater than +65 degrees C is sensed by the microprocessor, the overheat protect line is raised from its normal zero level to +5 volts DC. This signal, injected to the node of the differential amplifier, produces full cooling effect. Presence of the overheat protect signal can indicate a runaway Td heating condition, dirty mirror, or component failure.

2A1 TRANSMIT LOGIC



ANALOG SIGNAL CONDITIONING FUNCTION KEYED TEXT

GENERAL

Analog Signal Conditioning receives the resistance values representing Ta and Td and transforms those values into a multiplexed DC representation of the data values, Ta and Td.

① INPUT AMPLIFIERS

Operational amplifier U9A is driven by a precise 6.2 volt DC reference through input resistor R20. The dewpoint sensor resistance, Rtdp, is used as the feedback resistor for U9A, making the DC output of U9A exactly proportional to Rtdp; hence, U9A output voltage is an exact measure of the dewpoint temperature.

Operational amplifier U8A performs the same function in the ambient temperature channel.

② SCALING AMPLIFIERS

Amplifier U9B in the dewpoint channel provides gain and eliminates the zero offset level, yielding an output at a more convenient level for processing. At the output of U9B, zero voltage represents 0 degrees Celsius and +/- 2 volts DC represents +/- 50 degrees. Adjustments are provided for a small degree of offset trimming at zero and gain trimming at +50 degrees. These adjustments are normally made in conjunction with the use of the Calibrator.

Amplifier U8B performs identical scaling and offset correction functions in the ambient channel.

③ MULTIPLEXER

The DC analog voltages, Vdp and Vamb, are each brought to the input of a pair of gates, U10A and U10B. These gates, when disabled, present a series resistance on the order of 100 megohms, and when enabled present about 50 ohms to the signal path. The Vdp and Vamb gates are alternately switched on and off by a control input from the data transmitter at a rate of 5 cycles per second. The gates, their outputs tied together, alternately connect Vdp and Vamb to the output line.

④

VOLTAGE REFERENCE

A stable Zener reference diode, VR1, provides an input to voltage-follower amplifier U7A. This 6.2 volt reference is used by the data amplifiers and also as a reference in the data transmitter.

⑤

CALIBRATOR

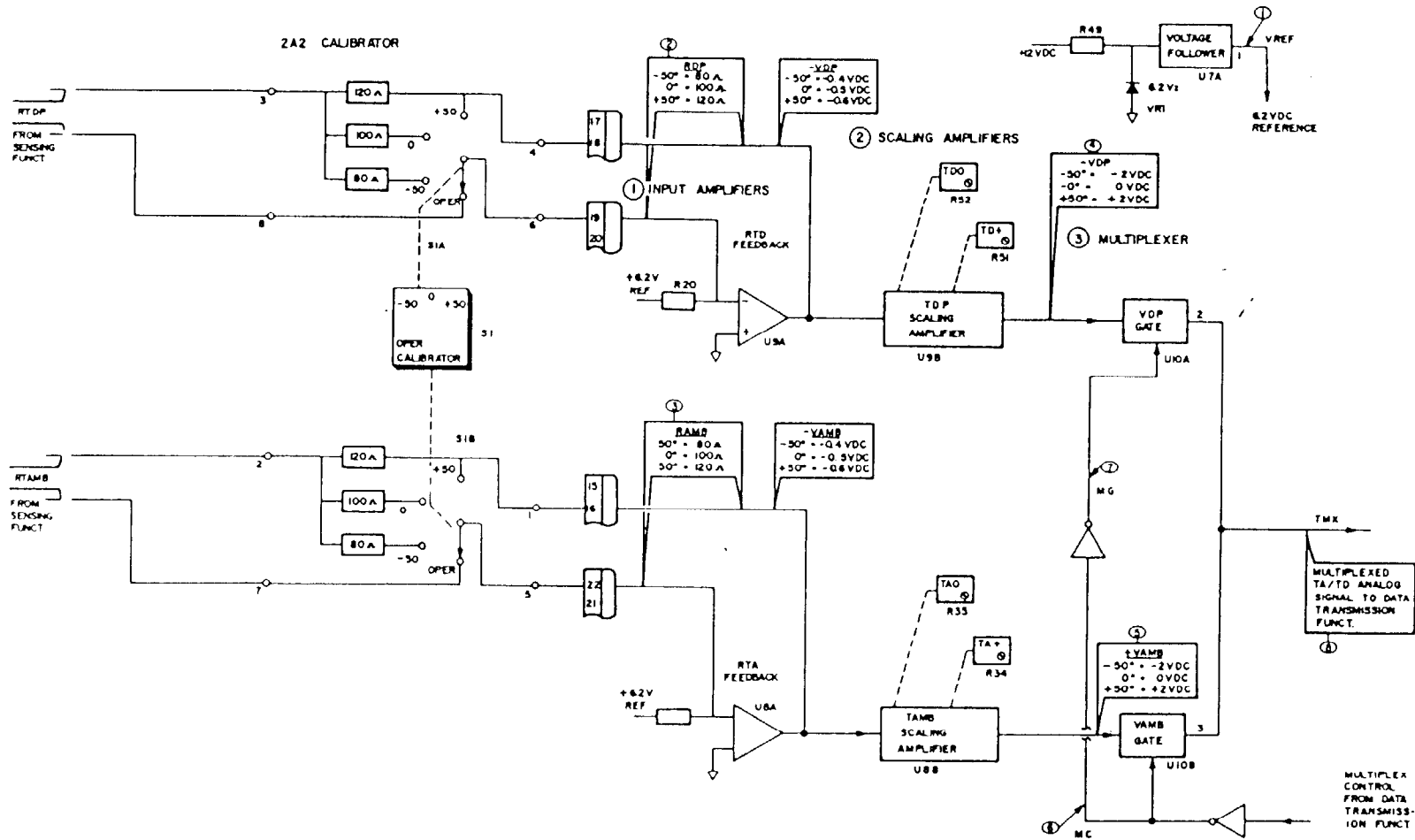
For use in checking operation of the system and also as an internal calibration standard, the Calibrate switch 2A2S1 permits the operator to substitute precision fixed resistors in place of the ambient and dewpoint temperature sensors. Three standard resistor values are included in each channel, providing simulated inputs at zero and +/- 50 degrees Celsius.

UNIT 2 TRANSMITTER

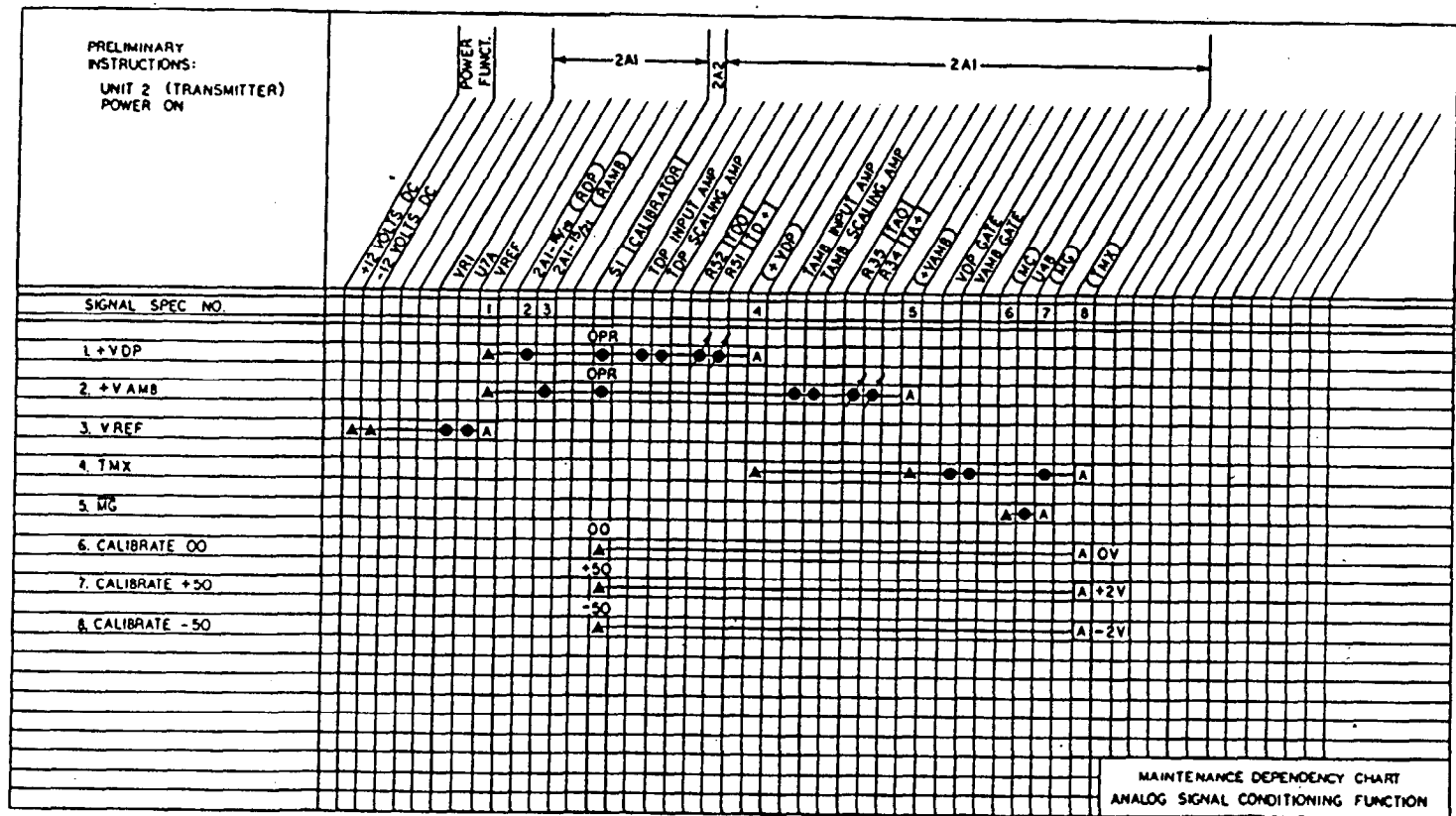
2A1 TRANSMIT LOGIC

⑤ CALIBRATOR

④ VOLTAGE REFERENCE



ANALOG SIGNAL CONDITIONING
FUNCTION



SPEC. NO.	SIGNAL SPECIFICATION	SPEC. NO.	SIGNAL SPECIFICATION
1	VREF IS +6.2 VOLTS DC. 1.03 V	7	PROBE: B1 VERT. 2V/CN HOR. 50 NS/CN SYNCH. INT. 0
2	RDP IS TEMP. SENSITIVE RESISTANCE AT 0° RDP = 100 Ω AT +50° RDP = 100 Ω AT -50° RDP = 100 Ω	8	PROBE: B1 VERT. 5V/CN HOR. 50 NS/CN SYNCH. INT. 0 NOTE: TA AND TB VOLTAGE LEVELS MAY VARY WITH DATA CONDITIONS
3	RAMP SPEC. IS SAME AS RDP		
4	+VDP VOLTAGE REPRESENTS DEW POINT TEMP. AT 0° VDP = 0 V AT +50° VDP = +2 V AT -50° VDP = -2 V		
5	+VAMB VOLTAGE REPRESENTS AMBIENT TEMP. SPEC IS SAME AS +VDP		
6	PROBE: B1 VERT. 2V/CN HOR. 50 NS/CN SYNCH. INT. 0		

GENERAL

Data Transmission receives multiplexed Vamb and Vdp DC analog signals from Analog Signal Conditioning and converts the data to a serial digital stream suitable for transmission to the remote display unit.

1 A/D CONVERTER

A single-chip analog-to-digital converter, U2, converts the input Ta/Td signal to a parallel straight binary output data bus. On the bus are 12 data bits and a sign bit. The converter is fully automatic, working in synchronism with the Data Processor. The output data bus handles the parallel Ta and Td data alternately.

2 DATA PROCESSOR

A single-chip microprocessor, type 68701, performs all of the timing and control functions of clocking the A/D converter through its cycle, and takes in the parallel binary data from the A/D converter. Under control of its resident program, the processor formats the data into a 600 Baud serial data stream. The processor also receives an Error indicator bit and includes it in the output format. The output serial signal is brought through a line driver, U11, to the transmitter output terminal.

Synchronism between the A/D converter and the data processor is controlled by "handshake" lines. A Status line from the A/D indicates to the processor when conversion is in process, and an output line from the processor to the Run/Hold input of the A/D signals the A/D that the processor is ready to receive new data.

3 ERROR BIT CONTROL

The Limit sensing circuit in the Optic Control circuit, normally a zero level, is summed with the +5 and -5 volt DC supply levels. Under normal conditions, the summation voltage is zero, or very close to zero. In the event of a failure in the optic control, or if a power supply line should fail, an unbalance will exist, positive or negative, in the summation level. The unbalance is amplified by U3A and U3B. Whether the unbalance is positive or negative, the result will be a positive output of the OR circuit of CR3 and CR4. This positive level is brought to an input of the Data Processor as the Error bit input.

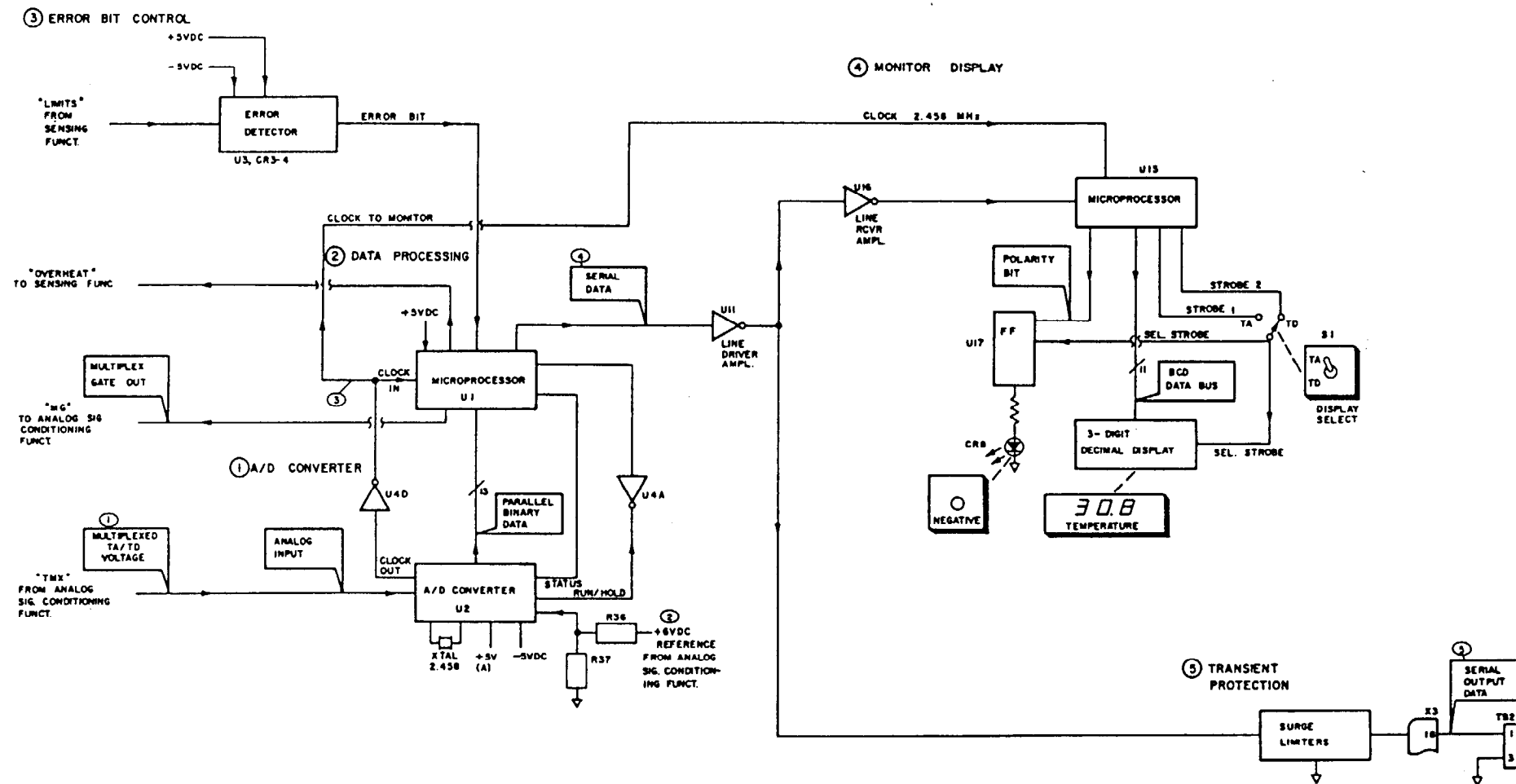
Also, internal to the microprocessor, the digitized values of Ta and Td are checked continuously. If either value exceeds +65 degrees C, the Error flag is set, indicating the presence of an overheat condition or a component failure.

④ MONITOR DISPLAY

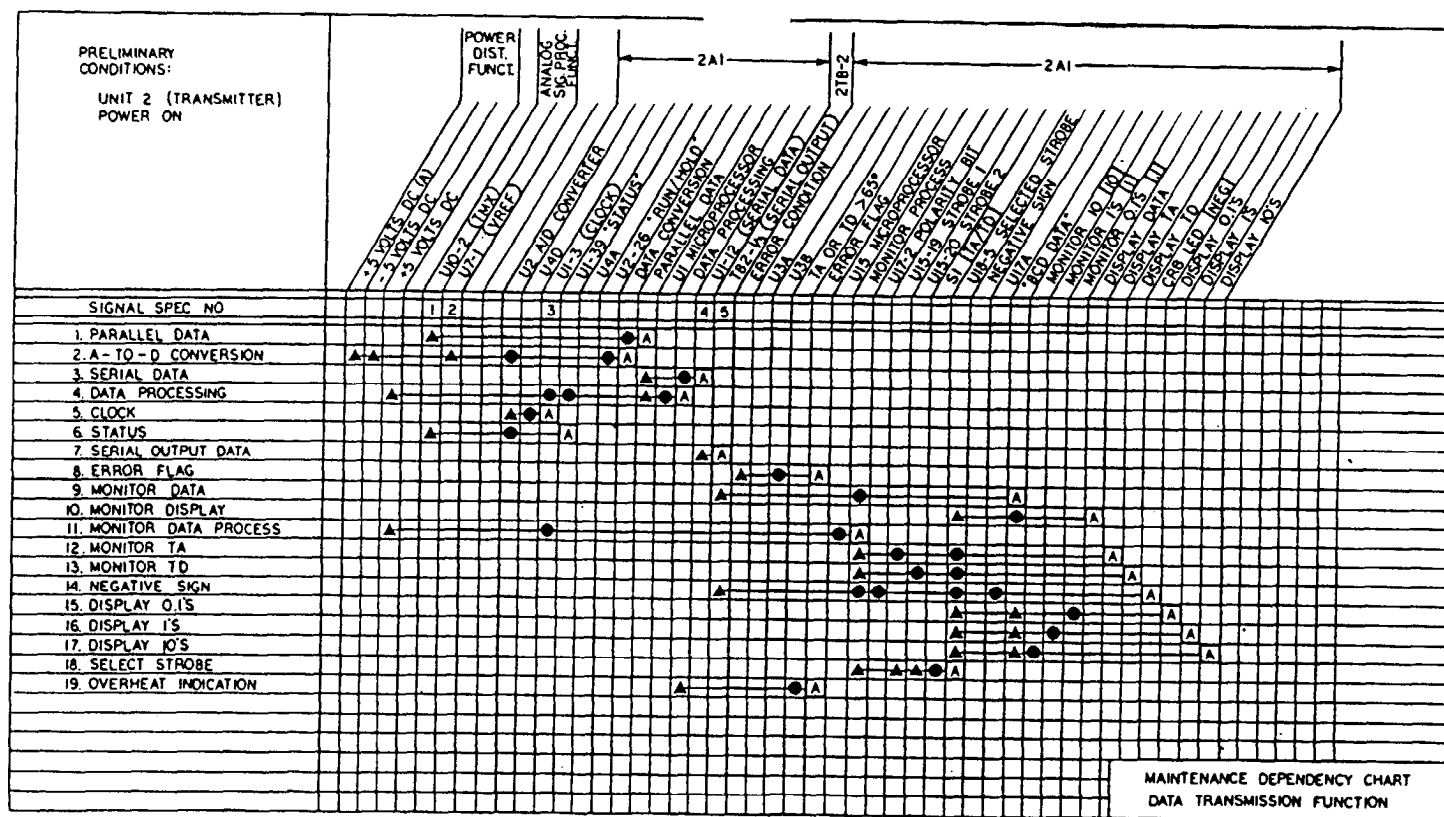
Built in as a part of the Transmit Logic PC assembly is a data receiver which serves as an aid in servicing the system. This circuit, the Monitor Display, contains all of the elements of a data display system, operating independently of the transmitter circuits. The transmitter output is connected through a line receiver amplifier, U16, into a separate Type 68701 microprocessor, U15, programmed to convert the data stream into parallel Binary Coded Decimal form suitable to drive numeric digital displays. A three-digit display is mounted on the Transmit Logic PC assembly, and reads out the current value of Ta or Td, selected by a toggle switch, S1, on the card. The Monitor microprocessor shares the common 2.458 Mhz clock which serves the A/D converter and the transmitter data processor.

UNIT 2 TRANSMITTER

2 A1 TRANSMIT LOGIC



DATA TRANSMISSION
FUNCTION



DATA DISPLAY FUNCTION KEYED TEXT

GENERAL

The Data Display Function is the output portion of the system. It receives the transmitted serial binary multiplexed Ta and Td data stream and converts the data into format suitable for panel display. Arithmetic manipulations are performed on the data, including S-minute averaging of Ta and Td, and recording maximum and minimum Ta. Data quality checks are performed, and the four data outputs, Ta, Td, Tmax, Tmin, are displayed on the front panel.

① DATA PROCESSOR

A Type 68701 single-chip microprocessor performs virtually all of the timing and logical functions of the receiver. Data is brought through a line receiver amplifier to the serial input port of the processor. Under control of the resident program, the processor gathers, computes, and stores the pertinent data. Output from the processor is on a 13-bit parallel bus which is time-multiplexed to Ta, Td, Tmax, and Tmin. As each of the data words is on the bus, a unique strobe pulse is generated, one for each of the four outputs. The data bus and the pertinent strobe are connected to each of the output display subassemblies on the panel. Output data is normally presented in degrees Celsius.

② NUMERIC DISPLAY

The Display assembly, 3A4, located behind the Display Unit front panel contains four identical 4-digit numeric plug-in display modules, for Ta, Tdp, Tmax, and Tmin. Each module consists of 5 latch/decoder/driver IC's and four incandescent decimal display elements. The drivers are connected to the common data bus, and are sampled by strobe lines, S1-S4. Each strobe line controls one of the four displays. Once each 37.5 seconds, all four display modules are updated.

③ ERROR INDICATION

When the error flag bit is received from the transmitter, or when certain other error conditions are detected by the receive logic, the Error output level goes high. This turns on a 2 pulse-per-second multivibrator, U2B, which flashes an Error LED indicator on the front panel.

4

DISPLAY BRIGHTNESS CONTROL

Built into each of the latch/decoder/drivers in the display modules is a blanking input. The blanking control line is driven by 100 pulse-per-second multivibrator U2A through one-shot U3 with controllable output pulse width. When the blanking line is up, the displays operate at full intensity; when the line is at zero, the displays are off. The positive pulse width of the blanking control line is controlled by the Display Dimmer control on the front panel, so that the average voltage on the pulsed line governs the apparent intensity of the displays.

5

FAHRENHEIT DISPLAY SELECTOR

The system output display is normally in degrees Celsius. At any time the operator may select Fahrenheit display by depressing the Fahrenheit Display pushbutton on the front panel. The button is momentary-action, so that the displays automatically revert to Celsius when the button is released. All four of the displayed values, Ta, Td, Tmax, Tmin, are affected by the Fahrenheit display selection. The conversion to Fahrenheit is controlled by software resident in the processor. The output BCD data is also affected by the Fahrenheit Display selector.

6

MAX/MIN RESET

The Tmax and Tmin displays may be reset to the present value by depressing the momentary Reset switch. To guard against accidental resetting, the Reset switch is connected in series with a pole of the Fahrenheit switch, so that both the Fahrenheit and the Reset switch must be pushed simultaneously to reset the Max/Min display.

7

DISPLAY TEST SWITCH

As a test of all the segments of the displays, depressing the momentary Display Test Switch causes all of the displays to indicate -188.8 degrees. In Display Test, the Error indicator is also caused to flash.

8

MEMORY PROTECTION

In the event of a momentary or prolonged power failure, the critical part of the data processor memory remains active, powered by a small battery located on the Receive Logic PC assembly. This battery is trickle-charged during normal operation, and has enough capacity to protect the memory for approximately 10 hours. Memory protection retains Tmax, Tmin, and the averaged values of Ta and Td.

9

OUTPUT DATA BUS

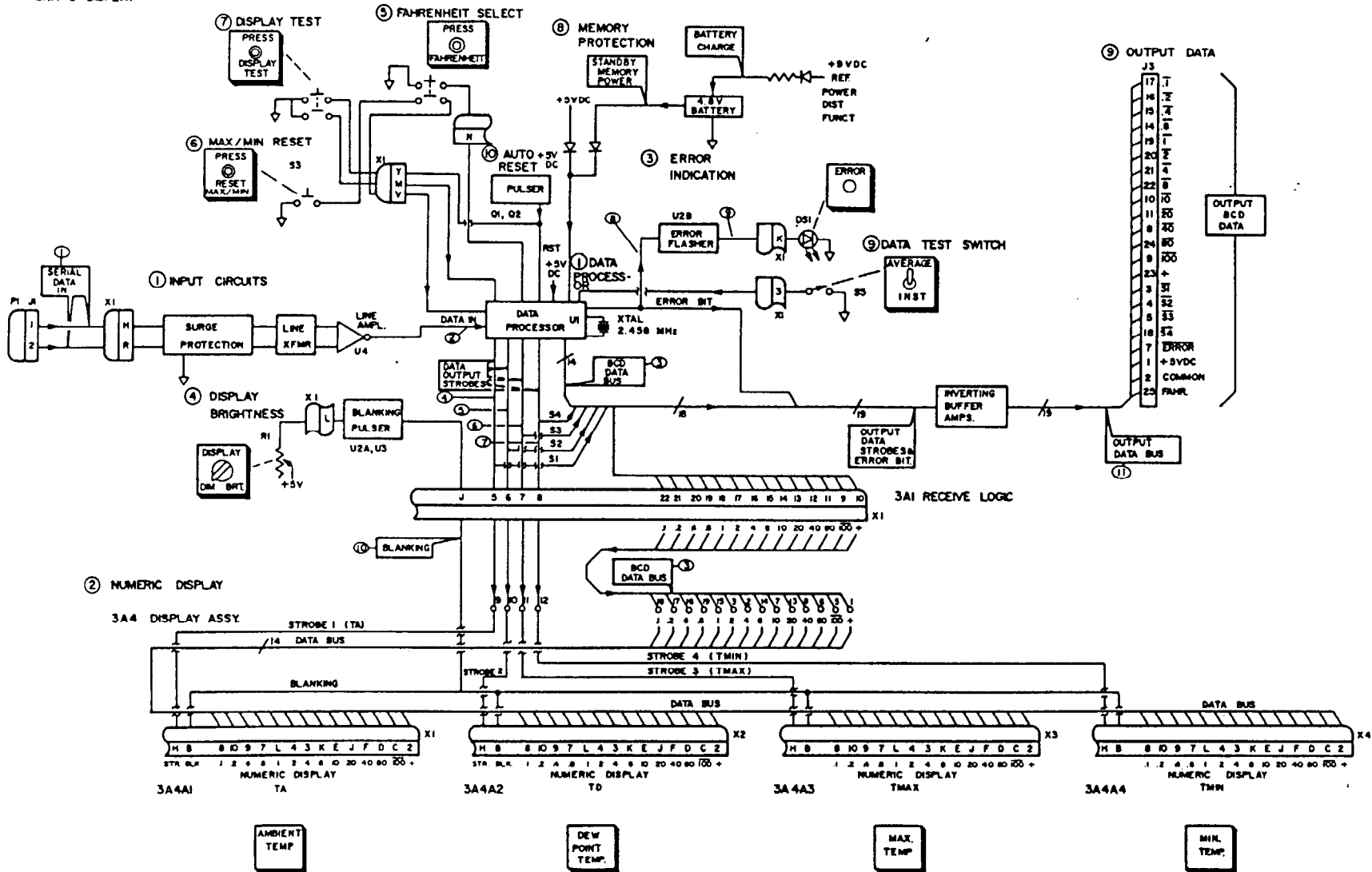
The multiplexed BCD data bus, which includes Ta, Td, Tmax, and Tmin data in sequence is buffered and brought to J3 on the rear panel of the Display Unit. Also brought out for external use are the data strobe lines, S1-S4, the Error bit, the +5 volt DC supply line, common line, and the Fahrenheit/Celsius select status.

10

AUTO RESET

Q1 and Q2, with their associated circuitry, form a level-sensitive one-shot multivibrator. If the +5 volt DC line drops below 4 volts, when power is removed or is about to fail, the circuit holds U1 pin 6 low, resetting the computer in an orderly manner. This reset does not affect the stored, protected data. Display Test also triggers the Reset circuit.

UNIT 3 DISPLAY



DATA DISPLAY
FUNCTION

POWER DISTRIBUTION FUNCTION KEYED TEXT

① TRANSMITTER POWER

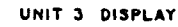
All power for the Aspirator, Unit 1, and the Transmitter, Unit 2, is derived from a single-phase 115 volt, 60 Hz input line into the transmitter enclosure. The Aspirator receives its power from the transmitter by way of an interconnecting cable.

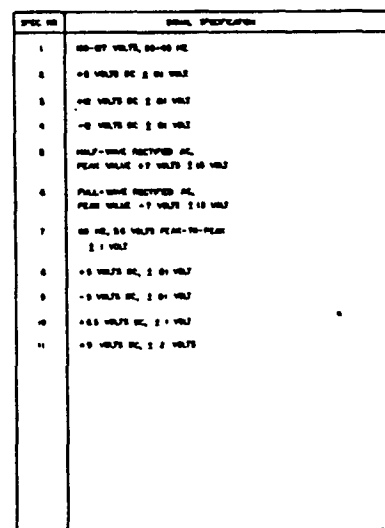
The transmitter includes a regulated +5 volt DC logic power supply, 2A3, and the Auxiliary Power Supply, 2A4. The Auxiliary Power Supply includes a DC-to-DC converter, 2A4A1, which converts +5 volts to regulated + and - 12 volts DC for the analog amplifiers. Also included in the Auxiliary Power Supply are power transformer T1 and the + and - 3 volt rectifiers which provide unregulated DC power for the thermo power amplifier. T1 also furnishes 5 volts AC excitation for the Optic Bridge illuminator LED.

② DISPLAY POWER

A separate 115 volt input line provides power to the remote display unit. The display unit includes a +5 volt DC regulated supply, identical to that used in the transmitter, and a +6 volt regulated DC supply which provides power for the numeric displays. The +6 volt supply also furnishes an unregulated +9 volt line which supplies charging current for the display standby battery.

INIT 1 ASPIRATOR





<i>Issue Date</i>	<i>Org.Code</i>
3-3-92	W/OS032

NATIONAL WEATHER SERVICE

Engineering Handbook

<i>Program</i>	<i>Part</i>	<i>Section</i>
EHB-8	01	1.5

MANUAL INDEX - LASER BEAM CEILOMETER

Number

Title

8-407*

Laser Ceilometer CT12K

Errata Sheet 1 Pen and Ink Changes to the Laser Beam
Ceilometer CT 12K Rev "E" Technical Manual (June 18, 1990)

* Supplied only to those using this equipment

ERRATA SHEET 1 (for Electronics Technicians)
Engineering Division
W/OS0321:BGM

Pen-and-ink changes to the Laser Beam Ceilometer CT 12K Rev "E" Technical Manual

General:

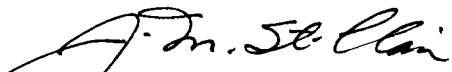
This errata sheet provides pen-and-ink changes to the Laser Beam Ceilometer (LBC) CT 12K Technical Manual.

Effect on Other Instructions:

None

Procedure:

1. Page number 228, change the heater part number from 2744 to 2719.
2. Page number 230, make the following change regarding the heater sub-assembly drawing UCT1300. The wire shown on heater block (E1) position #4 belongs in position #3. There should be no wires in position #4 on E1.



J. Michael St. Clair
Chief, Engineering Division